

REMARKS

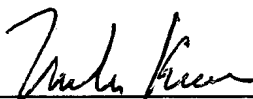
The specification has been amended to correct errors of a typographical and grammatical nature. Due to the large number of corrections thereto, applicants submit herewith a Substitute Specification, along with a marked-up copy of the original specification for the Examiner's convenience. Applicants submit that the substitute specification includes no new matter. Therefore, entry of the Substitute Specification is respectfully requested.

The claims have been amended to more clearly describe the features of the present invention.

Entry of the preliminary amendments and examination of the application is respectfully requested.

To the extent necessary, applicant's petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (501.43125X00) and please credit any excess fees to such deposit account.

Respectfully submitted,



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IN THE CLAIMS:

Please amend the claims as follows:

1. (currently amended) A display device comprising:

a face substrate which has an anode and a fluorescent material on an inner surface thereof;

a plurality of cathode lines which extend in ~~one~~a first direction, are juxtaposed in ~~another~~a second direction which crosses ~~one~~said first direction, and has electron emitting sources;

control electrodes which are constituted by arranging a plurality of strip-like electrode elements which cross the cathode lines in a non-contact state within a display region, extend ~~in the above-mentioned another~~ said second direction and are juxtaposed in ~~one~~said first direction, and have electron passing apertures for allowing electrons from the electron emitting sources to pass therethrough toward the face substrate;

a back substrate which has ~~the~~said control electrodes and ~~the~~said cathode lines disposed on an inner surface thereof and which faces the face substrate with a given distance therebetween; and

a frame body which is inserted between the face substrate and the back substrate and is arranged around the display region to ~~hold the~~ maintain said given distance, wherein

the cathode lines have extending ~~one end sides thereof~~ ends that are terminated outside the display region and inside the frame body, and a shield member is inserted between the terminals and the anode so as to ensure shielding between the terminals and the anode.

2. (original) A display device according to claim 1, wherein the shield

member is a member having the same shape as a strip-like electrode element which does not have the electron passing apertures.

3. (original) A display device according to claim 1, wherein the shield member is a member having the same shape as a strip-like electrode element which has the electron passing apertures.

4. (original) A display device according to claim 1, wherein the shield member is constituted of an insulation layer which covers the terminals.

5. (currently amended) A display device according to claim 1, wherein the shield member is constituted of a separate frame body which has a-substantially the same height as the frame body.

6. (currently amended) A display device comprising:
a face substrate which has an anode and a fluorescent material on an inner surface thereof;

a plurality of cathode lines which extend in one direction, are juxtaposed in ~~another~~ a second direction which crosses ~~one~~ said first direction, and has electron emitting sources;

control electrodes which are constituted by arranging a plurality of strip-like electrode elements which cross the cathode lines in a non-contact state within a display region, extend ~~in the above-mentioned another~~ said second direction and are juxtaposed in ~~one~~ said first direction, and have electron passing apertures for allowing electrons from the electron emitting sources to pass therethrough toward the face substrate;

a back substrate which has ~~the~~said control electrodes and ~~the~~said cathode lines disposed on an inner surface thereof and which faces the face substrate with a given distance therebetween; and

a frame body which is inserted between the face substrate and the back substrate and is arranged around the display region to ~~hold the~~maintain said given distance, wherein

the cathode lines have extending ~~one end sides thereof~~ends that are terminated at positions outside the display region, and ~~where the frame body is superposed on the cathode lines are superposed on the frame body and the terminals line ends so that said ends~~ and the anode are shielded from each other by the frame body.

add line numbers

DISPLAY DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention:

~~[0001]~~

The present invention relates to a display device which utilizes an emission of electrons into ^{a space that is in} a vacuum ^{state, space} which is defined between a face substrate and a back substrate; and, more particularly, ^{the invention relates} to a display device which ^{has} ~~can arrange~~ cathode lines having electron emitting sources and control electrodes which control ^{the} a quantity of electrons ~~led or~~ emitted from the electron emitting sources, and, at the same time, can exhibit stable display characteristics by ^{which} ~~holding~~ ^{maintaining} a vacuum ^{in the space} between the face substrate and the back substrate.

~~[0002]~~

2. Description of the Related Art

As a display device which exhibits ~~the~~ high brightness and ~~the~~ high definition, color cathode ray tubes have been widely used conventionally. However, along with the recent ^{desire} ~~request~~ for ~~the higher quality of images of~~ information ^{that is capable of providing images of higher quality} processing equipment or television broadcasting, the demand for planar displays (panel displays) which are light in weight and require a small space, while ^{also} exhibiting ~~the~~ high brightness and ~~the~~ high definition, has been increasing.

~~[0003]~~

of such panel display devices
As typical examples, liquid crystal display devices, plasma display devices and the like have been ^{developed} ~~put into practice~~. ^{More} ~~Further~~, particularly, as display devices which can ^{provide} ~~realize the~~ higher brightness, it is expected that various ^{other} kinds of panel-type display devices, including a display device which utilizes an emission of electrons from electron emitting sources into a vacuum (hereinafter referred to as "an electron emission type display device" or "a field emission type display device") and an organic EL display ^{device}, which is characterized by low power consumption, will be put into practice.

~~{0004}~~

Among ~~such~~ panel type display devices, ^{such} as the above-mentioned field emission type display device, a display device having an electron emission structure, which was ^{developed} ~~invented~~ by C. A. Spindt et al, a display device having an electron emission structure of a metal-insulator-metal (MIM) type, a display device having an electron emission structure which utilizes an electron emission phenomenon based on a quantum theory tunneling effect (also referred to as "surface conduction type electron emitting source,), and a display device which utilizes an electron emission phenomenon having a diamond film, a graphite film and carbon nanotubes and the like have been known.

~~{0005}~~

One type of field emission type display device includes a back substrate ^{on} which ~~forms~~ cathode lines having electron-

emission-type electron emitting sources and a control electrode ^{are formed}
 on an inner surface thereof, and a face substrate ^{on} which ~~forms~~
 an anode and a fluorescent material ^{are formed} on an inner surface ^{that} which
 faces the back substrate, wherein both substrates are laminated
 to each other by inserting a sealing frame between ^{the} inner
 peripheries of both substrates ^{after which} and the inside thereof is
 evacuated. Further, to set ^{the} a gap between the back substrate
 and the face substrate to a given value, gap holding members
 are provided between both substrates.

~~FIG. 16~~

^{schematic}
 Fig. 16 is a plan view of a back substrate ^{which illustrates} ~~for explaining~~
 the ~~schematic~~ constitution of a field emission type display
 device ~~and also is a schematic view~~ as viewed from the side of
 a face substrate (not shown in the drawing). The back substrate
 1 is configured such that, on a ^{insulation} substrate which is
 preferably made of glass, alumina or ^{insulating material} the like, a plurality of
 cathode lines 2 having electron emitting sources and ^{a plurality of} control
 electrodes of ^a plate member 4, constituted of a plurality of
 strip-like electrode elements, are formed. The cathode lines
 2 extend in ^{a first} ~~one~~ direction on the back substrate 1 and are arranged
 in plural numbers in parallel in ^{a second} ~~another~~ direction which crosses
^{the first} ~~one~~ direction. The cathode lines 2 are patterned by printing
 a conductive paste containing silver or the like, and electron
 emitting sources are arranged on the surface (face substrate
 side) of the cathode lines 2. ~~Extended~~ ^E End portions of the
 1

cathode lines 2 are ~~extended~~^{extended} out to the outside of a frame body 90, which constitutes a sealing frame, as cathode-line lead lines 20, while ~~the opposite~~^{the opposite} ~~other~~^{other} end portions extend to terminals 22, which are arranged inside the frame body 90 and outside the display region AR.

~~100071~~

On the other hand, the control electrodes 4 are manufactured as separate members and formed on the back substrate 1 at positions ~~to be~~^{to be} described later. That is, the control electrodes 4 are arranged close to and above the cathode lines 2 having the electron emitting sources ~~disposed thereon~~^{disposed thereon} (face substrate side), and, at the same time, ~~they~~^{they} face the cathode lines 2 ~~and are disposed~~^{and are disposed} with a given distance therebetween over the whole area of the display region AR. A large number of strip-like electrode elements 41, which constitute the control electrodes 4, extend in the above-mentioned ~~another~~^{second} direction and are juxtaposed in the above-mentioned ~~one~~^{first} direction. The strip-like electrodes 41 have open holes which constitute electron passing apertures at crossing portions thereof ~~aligned~~^{aligned} with the above-mentioned electron emitting sources on the cathode lines 2. Electrons which are emitted from the electron emitting sources of the cathode lines 2 pass through the electron passing apertures toward the face substrate side (anode side), and pixels are formed over the crossing portions.

~~100081~~

The control electrodes 4 are preferably formed such that a thin plate (having a thickness of about 0.05mm, for example) mainly made of aluminum or iron is formed into a large number of strip-shaped thin plates by etching using a photolithography technique, wherein a large number of electron passing apertures are formed in ~~the~~ ^{each} strip-shaped thin plate. The control electrodes 4 are fixed to the back substrate 1 by press members ~~that are~~ 60 or the like, formed of an insulation body made of glass material at a fixing portion which is arranged outside a display region AR. In the vicinity of the fixing portion or in the vicinity of the frame body 90, lead lines (control-electrode lead lines) 40 are connected to the control electrodes 4 and ^{one end of each of} the lead lines ^{extends} 40 ~~are pulled~~ out to the outer periphery of the display device. ^{use the frame body 90 to perform the} Here, it may be possible to ~~impart~~ function of the press member 60 ~~to the frame body 90~~. Then, in response to a potential difference between the cathode lines 2 and the ^{states} control electrodes 4, an emission quantity (including ON and OFF) of ^{the} electrons from ^{on} electron emitting sources provided ^{can be} ~~to~~ the cathode lines 2 ~~is~~ controlled.

~~to be~~

^{which is} On the other hand, the face substrate, ^{not shown in the} drawing, is formed of an insulation material having light transmissivity, such as glass or the like, and ~~forms~~ ^{are formed} anodes and fluorescent materials on an inner surface thereof. The fluorescent materials are ^{disposed in areas} ~~formed~~ corresponding to ^{the} pixels which

are formed ^{at} ~~on~~ the crossing portions between the cathode lines 2 and the control electrodes 4. In the drawing, x indicates the ^{direction of} ~~the~~ extension ~~direction~~ of the control electrodes 4, y indicates the ^{direction of} ~~the~~ extension ~~direction~~ of the cathode lines 2, and z indicates the direction which is perpendicular to the substrate surfaces of the back substrate and the face substrate.

~~FIG. 1~~

The back substrate 1 and the face substrate having the above-mentioned constitution are sealed together by way of the frame body 90, and the ^{space} ~~inside~~ sealed by the sealing frame 90 is evacuated through an exhaust hole 11 so that a vacuum of 10^{-5} to 10^{-7} Torr is created ^{therein} ~~in the inside~~ thus forming a field emission type display device. The above-mentioned electron emitting source is constituted of carbon nanotubes (CNT), diamond-like carbons (DLC), other field emission cathode material or other field emission shapes.

~~FIG. 2~~

^{examples of} Here, as literature which disclose ~~prior art which is relevant to~~ this type of electron emission type display device, except for the constitution of ^{the} ~~control electrodes~~ formed of the strip-like electrode elements, ^{reference is made to} Japanese Unexamined Patent Publication 1995-326306, Japanese Unexamined Patent Publication 1999-144652, Japanese Unexamined Patent Publication 2000-323078, and Japanese Unexamined Patent Publication 2001-338528 ~~and the like are named.~~

SUMMARY OF THE INVENTION

~~[0012]~~

The above-~~mentioned~~ ^{described} electron emission type display device is of a type in which electrons from ^{an} ~~the~~ electron emitting source pass through ^{an} ~~a~~ aperture ^a ~~the~~ formed in ~~the~~ control electrode and impinge on a fluorescent material of an anode and excite the fluorescent material to emit light and to ^{produce} ~~perform~~ a display.

This display device has ^{an} ~~the~~ excellent constitution ^{in the form of} ~~which~~ enables a planar display ^{which is capable of producing images that have} ~~which exhibits the~~ excellent characteristics, such as high brightness and high definition, ^{and} ~~is~~ light-weight ~~and~~ and requires a small space.

~~[0013]~~

However, in spite of such ^{characteristics} ~~an~~ excellent ^{conventional} ~~constitution~~, the electron emission type display device has ^{the} following drawbacks ^{which need to be addressed} ~~to be solved~~. That is, in the above-^{described} ~~mentioned~~ electron emission type display device having ~~the~~ cathode lines as shown in Fig. 16, ^{the} ~~the~~ distance between the cathode lines on the back substrate and the anode on the face substrate is set to several mm, and, ^{with} ~~under~~ such a constitution, the display device is operated by applying a cathode voltage of 0V to the cathode lines, by applying an anode voltage of several KV to some ten KV to the anode, and by applying a grid voltage of about 100 V to the control electrode. However, the terminals of the cathode lines extend and are present outside ^{area of the} ~~the~~ control electrodes, as well

as outside the display region AR; and, hence, the anode and the cathode lines directly face each other at the terminal portions.

Further, the terminals ~~exhibit~~ ^{have} edge portions; and, hence, ~~the display device has~~ ^{there is} a possibility that a spark or a dark current

is easily generated between the terminals and the anode. When ~~the~~ ^a spark or ~~the~~ dark current is generated, the display becomes

unstable, and, at the same time, the display is degraded, and, hence, the reliability of display is ~~damaged~~ ^{reduced}. Further, an undesired

current, which does not contribute to the display, flows so that ~~the~~ ^{the} extension of life ~~time~~ ^{of the device} is impeded. ~~In this manner,~~ ^P the

~~conventional~~ electron emission type display device has the above-mentioned drawbacks, and ~~the~~ ^{so there is a need to provide some} means for solving such drawbacks are demanded.

~~[0014]~~

Accordingly, it is an object of the present invention to provide a reliable display device which is capable of ~~performing~~ ^{producing a} display of high definition and ~~exhibits the~~ ^{of having a} long life ~~time~~ by preventing the generation of a spark or a dark current between the terminals of the cathode lines and ~~an~~ ^{the} anode.

~~[0015]~~

To achieve the above-mentioned object, the present invention is characterized by ~~inserting~~ ^{an arrangement in which} a shield member ^{is inserted} between the terminals of cathode lines and ~~an~~ ^{the} anode so as to ensure shielding between the terminals and ~~an~~ ^{the} anode. Hereinafter, typical constitutions of the display device according to the present invention ~~are~~ ^{will be} described.

~~00167~~

The display device according to the present invention includes a face substrate, which has an anode and a fluorescent material on an inner surface thereof, ^{and a back substrate which has} a plurality of cathode lines, which extend in ^{a first} ~~one~~ direction, are juxtaposed in ^{a second} ~~another~~ direction which crosses the ^{first} ~~above-mentioned one~~ direction, and ^{which have} ~~has~~ electron emitting sources, ^{disposed thereon} ~~a~~ ^{and a plurality of} control electrodes, which are constituted by arranging a plurality of strip-like electrode elements ^{to} ~~which~~ cross the above-mentioned cathode lines in a non-contact state within a display region in parallel, ^{so as to} extend in the ^{second} ~~above-mentioned another~~ direction and ^{be} ~~are~~ juxtaposed in the above-mentioned ^{first} ~~one~~ direction. ^{The control electrodes} ~~and~~ have electron passing apertures for allowing electrons from the electron emitting sources to pass therethrough toward the above-mentioned face substrate. ^{The} ~~a~~ back substrate, which has the above-mentioned control electrodes and the above-mentioned cathode lines ^{disposed} on an inner surface thereof, ~~and~~ faces the face substrate with a given distance therebetween, and a frame body, which is inserted between the above-mentioned face substrate and the back substrate, ~~and~~ is arranged around the above-mentioned display region to ^{establish and maintain} ~~hold~~ the above-mentioned given distance ^{between the substrates}.

~~00177~~

In accordance with the present invention
Then, the cathode lines have ~~extending~~ one end ~~sides~~ thereof terminated outside the display region and inside the frame body, and a shield member is inserted between the

terminals and the anode so as to ensure shielding between the terminals and the anode.

~~100187~~

As the above-mentioned shield member, a member having the same shape as ^{the} strip-like electrode elements, which do not have the above-mentioned electron passing apertures, or a strip-like electrode element which has the above-mentioned electron passing apertures, can be used. Further, the shield member may be constituted of an insulation layer which covers the above-mentioned terminals, and the shield member ^{also} may be ~~also~~ constituted of a separate ^{inner} frame body which has ~~a~~ substantially ^{the} same height as the ^{outer} frame body.

~~100197~~

According to the above-mentioned ^{examples} ~~constitutions~~, by inserting the shield member between the terminals of the cathode lines and the anode to ensure shielding between the terminals of the cathode lines and the anode, it is possible to prevent the generation of a spark and an undesired current, whereby it is possible to provide a display device which exhibits high reliability and ^{less a} long life ~~without~~.

~~100207~~

Further, a display device according to the present invention includes a face substrate which has an anode and a ^{and a back substrate which has} fluorescent material on an inner surface thereof, ^{a first} a plurality of cathode lines, which extend in ~~one~~ direction, are juxtaposed

in another ^{a second} direction which crosses the above-mentioned ^{first} ~~one~~ direction, and ^{which have} ~~has~~ ^{disposed thereon} electron emitting sources, ^{and a plurality of} control electrodes, which are constituted by arranging a plurality of strip-like electrode elements in parallel ^{to} ~~which~~ cross the above-mentioned cathode lines in a non-contact state within a display region, ^{so as to} extend in the ^{second} ~~above-mentioned another~~ direction and ^{be} ~~are~~ juxtaposed in the ^{first} ~~above-mentioned one~~ direction, ^{The control electrodes} ~~and~~ have electron passing apertures for allowing electrons from the electron emitting sources to pass therethrough toward the above-mentioned face substrate ^{the} ~~and~~ back substrate, which has the above-mentioned control electrodes and the above-mentioned cathode lines on an inner surface thereof, ~~and~~ faces the face substrate with a given distance therebetween, and a frame body, which is inserted between the above-mentioned face substrate and the back substrate, ~~and~~ is arranged around the above-mentioned display region ^{establish and maintain} to ~~hold~~ the above-mentioned given distance ^{between the substrates}.

~~{0021}~~

The above-mentioned cathode lines have ~~extending~~ one end ~~sides~~ thereof terminated at positions outside the above-mentioned display region and where ^{the frame body is superposed on} the cathode lines ~~are~~ ~~superposed on the frame body~~, and hence, it is possible to ensure shielding between the terminals and the above-mentioned anode using the frame body, whereby it is unnecessary to add another member for shielding ^{so that the above} ~~and a~~ cost can be ~~also~~ reduced.

~~[0022]~~

It is needless to say that the present invention is not limited to the above-mentioned ^{examples or to the} ~~constitutions and constitutions~~ ^{to be} ~~of~~ embodiments described later, and various modifications can be made without departing from the technical concept of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a plan view ^{showing} ~~for schematically explaining~~ the constitution ~~of an essential part~~ of a back panel ~~side for~~ ^{representing a} ~~explaining the~~ first embodiment of a display device according to the present invention.

Fig. 2 is a cross-sectional view ~~of an essential part~~ taken along a line A-A in Fig. 1.

Fig. 3 is a plan view ^{showing} ~~for schematically explaining~~ the constitution ~~of an essential part~~ of a back panel ~~side for~~ ^{representing a} ~~explaining the~~ second embodiment of a display device according to the present invention.

Fig. 4 is a cross-sectional view ~~of an essential part~~ taken along a line B-B in Fig. 3.

Fig. 5 is a plan view ~~for schematically~~ showing the constitution ~~of an essential part~~ of a back panel ~~side for~~ ^{representing a} ~~explaining the~~ third embodiment of a display device according to the present invention.

Fig. 6 is a cross-sectional view ~~of an essential part~~

taken along a line C-C in Fig. 5.

Fig. 7 is a plan view ~~for schematically~~ showing the constitution of ~~an essential part~~ of a back panel ~~side for~~ ^{representing a} explaining the fourth embodiment of a display device according to the present invention.

Fig. 8 is a cross-sectional view of ~~an essential part~~ taken along a line D-D in Fig. 7.

Fig. 9 is a plan view ~~for schematically~~ showing the constitution of ~~an essential part~~ of a back panel ~~side for~~ ^{representing a} explaining the fifth embodiment of a display device according to the present invention.

Fig. 10 is a plan view ~~for schematically~~ showing the constitution of ~~an essential part~~ of a back panel ~~side for~~ ^{representing a} explaining the sixth embodiment of a display device according to the present invention.

Fig. 11 is a plan view ~~for schematically~~ showing the constitution of ~~an essential part~~ of a back panel ~~side for~~ ^{representing a} explaining the seventh embodiment of a display device according to the present invention.

Fig. 12 is a cross-sectional view of ~~an essential part~~ taken along a line E-E in Fig. 11.

Fig. 13 is a plan view ~~for schematically~~ showing the constitution of ~~an essential part~~ of a back panel ~~side for~~ ^{representing an} explaining the eighth embodiment of a display device according to the present invention.

Fig. 14 is a developed perspective view ~~for schematically~~
showing the ~~whole~~ ^{overall} constitution of the display device of the
present invention.

Fig. 15 is an ~~explanatory view of an example of an~~
equivalent circuit ^{diagram} of the display device of the present
invention.

Fig. 16 is a plan view of a back substrate ^{as provided in} ~~for explaining~~
~~the schematic constitution of a field emission type display~~
device.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

~~FIG. 1~~

Preferred embodiments of the present invention ^{will be}
explained in detail hereinafter in conjunction with ^{the} drawings
~~which show these embodiments.~~ Fig. 1 is a plan view ~~for~~
schematically showing the constitution of ~~an essential part at~~
a back substrate ^{in a} ~~side for explaining the~~ first embodiment of
a display device according to the present invention, and Fig.
2 is a cross-sectional view ~~of an essential part~~ taken along
a line A-A in Fig. 1. Here, in Fig. 2, the ~~arrangement~~
relationship among a face substrate 21, an anode 23 and a
fluorescent material 24 is indicated by a phantom line.

~~FIG. 2~~

^{As seen in}
Fig. 1 and Fig. 2, ~~reference symbol 1 indicates~~ a back
substrate ~~and the back substrate 1~~ is constituted of an

~~insulation~~ substrate suitably formed of glass, alumina or the like. Reference symbol 2 indicates ~~Cathode lines~~² which extend in ~~one~~^{a first} direction (y direction) on the back substrate 1 and are juxtaposed in a plural number in ~~another~~^{a second} direction (x direction) which crosses ~~one~~^{the first} direction. The cathode lines 2 are formed by patterning ~~a~~^{using} a conductive paste containing silver or the like by printing or the like, and electron emitting sources 25 are formed on surfaces thereof (face substrate 21 side). Carbon nanotubes, for example, are used as the electron emitting sources 25, as described previously.

~~[0025]~~

Further, ~~extending~~^{each of} one end ~~portions~~^a of the cathode lines 2 are ~~pulled~~^{extends} out as ~~a~~^a cathode-line lead line ~~20~~^{portion} to the outside of a frame body 90, which constitutes a sealing frame, while ~~the opposite~~^{the opposite} ~~another~~^{another} end portions of the cathode lines 2 extend to terminals 22 inside the frame body 90 and outside a display region AR. In this embodiment, the cathode lines 2 are ~~configured~~^{positioned} such that the cathode-line lead line ~~20~~^{portions} are arranged ~~every other~~^{at} ~~one~~^{as seen in} line at upper and lower ~~sides~~^{sides} of the back substrate 1 ~~on~~^{as seen in} the drawing.

~~A plurality of~~^{A plurality of} Reference symbol 4 indicates control electrodes and these control electrodes 4 are arranged above (face substrate 21 side) and close to the cathode lines 2 ~~having~~^{that have} the electron emitting sources 25, that is, close to the cathode lines 2 by approximately 0.01mm or less. Further, the control electrodes 4 are arranged over at least the whole area of the display region

so as
AR₁ to face the cathode lines 2.

~~100261~~

The control electrodes 4 and the cathode lines 2 are electrically insulated from each other. Reference symbol 40 indicates control-electrode lead lines, and these control-electrode lead lines 40 are configured to ~~be pulled out~~ ^{extend} to both ~~of~~ ^{the} left and right ~~ends~~ ^{sides} of the back substrate 1, ~~as seen in~~ ^{as seen in} the drawing. Reference symbol 41 indicates ⁴¹ ~~A~~ plurality of strip-like electrode elements ^{which} constitute the control electrodes 4. The strip-like electrode elements 41 are formed of an iron-based stainless steel material or an iron material, ~~and have~~ ^{they have} a plate thickness of approximately 0.025mm to 0.150mm. ~~The control electrodes 4 are constituted by making~~ ^{These strip-like electrode elements 41 extend in the x direction and are juxtaposed in the y direction.} It is preferable that the strip-like electrode elements 41 are integrally formed with the control-electrode lead lines 40. ~~Reference symbol 42 indicates~~ ^{are} ~~Electron passing apertures,~~ ^{which} which are constituted of holes, ^{are} formed in the strip-like electrode elements 41. One or a plurality of electron passing apertures 42 are arranged at ~~a crossing portion between~~ ^{positions where} the strip-like electrode element 41 ~~crosses each of the~~ ^{subdivided positions are} and the cathode lines 2, ~~and at a position~~ coaxial with the electron emitting sources 25 so as to allow the electrons emitted from ~~the~~ ^{each} electron emitting source 25 to pass therethrough toward the anode 23. The distance between the anode 23 and the above-

mentioned control electrodes 4 is set to several mm, that is, 3mm, for example.

~~100277~~

~~Reference symbol 5 indicates~~ ^SStrip-like shield members, ~~The shield members 5~~ are arranged close to the outermost control electrodes 4 such that the shield members 5 cover the terminals and isolate them 22 of the cathode lines 2_A from the anode 23. Using two shield members 5 (51, 52), the terminals 22 and the anode 23 are shielded from each other. In this example, although ^{the} ~~the~~ distance between the shield members 5 and the anode 23 is set ^{to be} ~~equal~~ to ^{the} ~~the~~ distance between the control electrodes 4 and the anode 23, the distance may be determined based on the shape, the potential or the like of the shield members 5.

~~100281~~

The shield members 5 may have the same specification as the above-mentioned strip-like electrode elements 41, except that the shield members 5 do not have ~~the~~ electron passing apertures 42. Alternatively, the shield members 5 may use the strip-like electrode element 41 per se. In this case, by adopting the arrangement in which the electron passing apertures 42 and the above-mentioned terminals are not ^{on} ~~superposed~~ ^{on} ~~the~~ each other, ^{on} ~~the~~ further shielding effect can be expected. Further, by electrically connecting the shield members 5 and the control electrodes 4, it is possible to enhance the shielding effect.

~~{0029}~~

Based on such a constitution, electrons emitted from the electron emitting sources 25 pass through the electron passing apertures 42 of the control electrode 4, to which a grid voltage of approximately 100V is applied while receiving a control, and ^{that is} impinge on the fluorescent material 24, formed on the anode 23 of the face substrate 21, to which an anode voltage of several KV to several tens KV is applied, whereby light is emitted from the fluorescent material 24, ^{so as} to ^{produce} perform a given display. During such an operation, according to ~~the constitution of~~ this embodiment, the terminals 22 of the cathode lines 2 and the anode 23 are shielded from each other ^{around the periphery of the display region} by the shielding materials 5; and, hence, it is possible to prevent the anode potential from affecting the terminals 22, so that the generation of a spark or a dark current between the terminals 22 and the anode 23 can be suppressed. ^{Thus,} ~~the~~ ^{the} degradation of ^{the} display can be obviated, whereby ^a ~~the~~ display device which can ^{produce a} ~~perform~~ the high-definition display and exhibit ^{over a} ~~the~~ high reliability, ~~and the~~ long lifetime can be obtained.

~~{0030}~~

Fig. 3 is a plan view schematically showing the constitution ~~of an essential part of a back substrate side for~~ ^{in a} explaining the second embodiment of the display device according to the present invention. Further, Fig. 4 is a cross-sectional view ~~of an essential part~~ taken along a line

B-B in Fig. 3. Parts having ~~the~~ functions identical to the parts shown in Fig. 1 and Fig. 2 are ~~given~~ ^{identified by the} same symbols. Here, in Fig. 4, the ~~arrangement~~ relationship among a face substrate 21, an anode 23 and a fluorescent material 24 is indicated by a phantom line in the same manner as the display device shown in Fig. 2.

~~100311~~

In Fig. 3 and Fig. 4, reference symbol 35 indicates shield members. The shield members 35 are formed of an insulating material, such as frit glass, and are applied and arranged to cover terminals 22. Since the shield members 35 are arranged in a vacuum atmosphere, it is preferable to ~~constitute~~ ^{form} the shield members 35 ~~using~~ ^{of} a material which emits a small amount of gas. When the shield members 35 are formed of ~~the~~ ^a material such as frit glass, which requires ~~the~~ high temperature treatment, by baking the material before forming the electron emitting sources 25, it is possible to ~~expect~~ ^{obtain} an advantageous effect ⁱⁿ that ~~any~~ ^{the} adverse influence ~~on~~ ^{on} the electron emitting sources 25 can be reduced.

~~100321~~

Due to ~~such a~~ ^{the} constitution ~~of~~ ^{provided by} this embodiment, the terminals 22 can be completely shielded by the shield members 35, and, hence, a drawback attributed to ~~the~~ turnaround of ~~an~~ ^{the} electric field can be solved. Accordingly, ~~not to mention~~ ^{in addition to} the above-mentioned effect ~~to suppress~~ ^{in which} the generation of ~~the~~ ^a spark

and ~~the~~^a dark current^{is suppressed}, the workability can be enhanced by integrally handling the shield members 35 and the back substrate 1; and, at the same time, it is possible to obtain ~~the~~^a display device which can ~~perform~~^{produce a} display with high definition and can exhibit high reliability and ~~a~~^a long lifetime.

~~100333~~

Fig. 5 is a plan view schematically showing the constitution of an essential part of a back substrate side for explaining the third embodiment of the display device according to the present invention. Further, Fig. 6 is a cross-sectional view of an essential part taken along a line C-C in Fig. 5. In Fig. 5 and Fig. 6, parts having the functions identical to the parts shown in Fig. 1 to Fig. 4 are given same symbols. Here, in Fig. 6, the arrangement relationship among a face substrate 21, an anode 23 and a fluorescent material 24 is indicated by a phantom line in Fig. 6 in the same manner as the display device shown in Fig. 2 and Fig. 4.

~~100341~~

In Fig. 5 and Fig. 6, reference symbol 45 indicates a shield member ~~in~~^{having} a frame shape. The shield member 45 is formed of a glass plate or a ceramic plate, and ~~is~~^{it} is arranged such that a lower end surface thereof covers terminals 22 inside a frame body 90, which constitutes a sealing frame. ~~The~~^{the} height of the shield member 45 is set ~~equal~~^{to be} to or lower than ~~the~~^{the} height of the frame body 90. ~~The~~^{the} display region AR is ~~set~~^{located} inside the shield

member 45.

[0035]

Due to ~~such a~~^{the} constitution ~~of~~^{provided by} this embodiment, the terminals 22 can be completely shielded by the shield member 45, and, hence, ~~a~~^{the} drawback attributed to ~~the~~^{the} turnaround of ~~an~~^{in addition to} electric field can be solved. Accordingly, ~~not to mention~~^{in which} the above-mentioned effect ~~to suppress~~^a the generation of ~~the~~^a spark and ~~the~~^{is suppressed} dark current, the shield member 45 cooperates with the frame body 90 to set ~~a~~^{the} distance between ~~a~~^{the} back substrate 1 and ~~a~~^{the} face substrate 21 to a fixed value, thus preventing ~~the~~^{the} degradation of ~~a~~^a display, whereby it is possible to obtain ~~the~~^a display device which can ~~perform~~^{produce a} display with high definition and can exhibit high reliability and ~~a~~^a long lifetime.

[0036]

Fig. 7 is a plan view schematically showing the constitution of ~~an essential part of~~^{representing a} a back substrate ~~side for~~^{explaining the} fourth embodiment of the display device according to the present invention. Further, Fig. 8 is a cross-sectional view ~~of an essential part~~ taken along a line D-D in Fig. 7. In Fig. 7 and Fig. 8, parts having ~~the~~^{identified by the} functions identical to the parts shown in Fig. 1 to Fig. 6 are ~~given~~^{As seen} same symbols. ~~Here~~^{Here}, in Fig. 8, the ~~arrangement~~ relationship among ~~the~~^{the} face substrate 21, ~~an~~^{the} anode 23 and ~~a~~ fluorescent material 24 is indicated by a phantom line ~~in Fig. 8~~ in the same manner as the display device shown in Fig. 2, Fig. 4 and Fig. 6.

~~{0037}~~

In the fourth embodiment shown in Fig. 7 and Fig. 8, ^{the} cathode-line lead lines 20 of ^{on} cathode lines 2 are arranged ^{the display area AL on} only one ~~end face~~ side of ^{the} the back substrate 1, and, hence, this embodiment differs in constitution from the above-mentioned respective embodiments. Due to such an arrangement of the cathode-line lead lines 20 of the cathode lines 2, the terminals ^{are} 22 are also arranged in one row in the y direction, and, hence, only one shield member 55 is ^{provided} ~~arranged so as~~ to ensure shielding between the terminals 22 and ^{the} an anode 23. The constitution, the arrangement, the position and the like of the shield member 55 ^{are} ~~adopt~~ the same ^{a single shield member of} constitution as that of the first embodiment, ^{reference to} ~~which was~~ ^{described} explained in conjunction with ^{reference to} Fig. 1 and Fig. 2.

~~{0038}~~

Due to ^{the} ~~such a~~ constitution ^{provided by} of this embodiment, ~~not to~~ ^{in addition to} ~~mention~~ the above-mentioned effect ^{on which} to ~~suppress~~ the generation of ^a the spark and ^a the dark current, ^{is suppressed} since the cathode-line lead lines 20 are pulled out only to ~~the one end face~~ side ^{on} of the back substrate 1, it is possible to obtain an advantageous effect ⁱⁿ that the connection with external circuits is facilitated, whereby it is possible to obtain ^a the display device which can ^{produce a} ~~perform~~ display with high definition and can exhibit high reliability and ^a long lifetime.

~~{0039}~~

~~Next,~~ Fig. 9 is a plan view schematically showing the

constitution ~~of an essential part~~ of a back substrate ~~side for~~
~~explaining the~~ ^{in a} fifth embodiment of the display device according
to the present invention. In Fig. 9, parts having ~~the~~ functions
identical to the parts shown in Fig. 1 to Fig. 8 are ~~given~~ ^{identified by the} same
symbols. In the embodiment shown in Fig. 9, ~~in the same manner~~ ^{basic structural features}
~~employed in~~ as the embodiment shown in Fig. 7 and Fig. 8, ^{wherein} cathode-line lead
lines 20 of cathode lines 2 are arranged only at one ~~end face~~
~~the display area on~~ ^{are employed} side of the back substrate 1. In such a constitution, the
terminals 22 are ~~covered with and~~ ^{additionally} are shielded by a shield member
65, which constitutes an insulator, such as frit glass, in the same
manner as ~~the second embodiment explained~~ ^{employed in} ~~in conjunction with~~ ^{which was described}
Fig. 3 and Fig. 4.

~~[0040]~~

By adopting the constitution ^{provided by} of ~~this~~ ^a embodiment, it is
possible to obtain ~~the~~ ^{produce a} display device which can ~~perform the~~
high-definition display and can exhibit high reliability and
long lifetime, ^{simultaneously} while obtaining the advantageous effects of the
above-mentioned second and fourth embodiments ~~simultaneously~~.

~~[0041]~~

~~Next~~ Fig. 10 is a plan view schematically showing the
constitution ~~of an essential part~~ of a back substrate ~~side for~~
~~explaining the~~ ^{representing a} sixth embodiment of the display device according
to the present invention. In Fig. 10, parts having ~~the~~
functions identical to the parts shown in Fig. 1 to Fig. 9 are
~~given~~ ^{identified by the} same symbols. In the embodiment shown in Fig. 10, in the

same manner as the embodiment shown in Fig. 7 to Fig. 9, cathode-line lead lines 20 of cathode lines 2 are arranged only at one ~~end face~~ ^{the display area A-L on} side of the back substrate 1. In such a constitution, the terminals 22 are covered with a plate-like shield member 75, which is formed of a glass plate or a ceramic plate, so as to provide shielding between ~~an~~ ^{the} anode 23 and the terminals 22 in the same manner as the third embodiment ~~which was described~~ ^{explained} in conjunction with Fig. 5 and Fig. 6.

[0042]

By adopting the constitution ^{provided by} of this embodiment, it is possible to obtain ^a the display device which can ^{produce a} ~~perform the~~ high-definition display and can exhibit high reliability and ^a long lifetime, ^{simultaneously} while obtaining the advantageous effects of the above-mentioned third and fourth embodiments ~~simultaneously~~.

[0043]

Fig. 11 is a plan view schematically showing the constitution ~~of an essential part~~ ^{representing a} of a back substrate ~~side for~~ ^{explaining the} seventh embodiment of the display device according to the present invention. Further, Fig. 12 is a cross-sectional view ~~of an essential part~~ taken along a line E-E in Fig. 11. In Fig. 11 and Fig. 12, parts having ~~the~~ functions identical to the parts shown in Fig. 1 to Fig. 10 are ^{identified by the} ~~given~~ same symbols. ~~Here,~~ ^{In} Fig. 12, the arrangement relationship among ^{the} ~~a~~ face substrate 21, ^{the} ~~an~~ anode 23 and ~~a~~ fluorescent material 24 is indicated by a phantom line in the

same manner as the display device shown in Fig. 2, Fig. 4, Fig. 6 and Fig. 8.

~~[0044]~~

In the seventh embodiment shown in Fig. 11 and Fig. 12, ^{the} terminals 22 of ^{the} cathode lines 2 are made to extend below a frame body 90 which constitutes a sealing frame, and ~~superposed on the~~ ^{is superposed on the terminals 22,} frame body 90, whereby the frame body 90 ~~is also served~~ ^{serves} as a shield member which performs shielding between the terminals 22 and the anode 23. Here, in this embodiment, cathode-line lead lines ^{extend alternately on} 20 of the cathode lines 2 ~~are arranged at both end faces~~ ^{side} of the ^{display area AR on the} back substrate 1, every other line.

~~[0045]~~

Due to ~~such a~~ ^{the} constitution ^{provided by} of this embodiment, it is possible to make ~~the~~ ^{an} existing constitutional member also function as the shield member, ~~not to mention~~ ^{in addition to} the above-mentioned advantageous effect, ^{in which} ~~of suppressing~~ the generation of ^a spark or ^a dark current, ^{is suppressed} ^{whereby an} the enhancement of operability and ^a reduction of cost can be expected, ^{so as to make} whereby it ~~is~~ possible to obtain ^a the display device which can ~~perform the~~ ^{produce a} high-definition display and can exhibit high reliability and ^a long lifetime.

~~[0046]~~

Fig. 13 is a plan view schematically showing the constitution ~~of an essential part~~ ^{representing an} of a back substrate, ~~side for~~ ^{explaining the} eighth embodiment of the display device

according to the present invention. In Fig. 13, parts having ~~the~~ functions identical to the parts shown in Fig. 1 to Fig. 12 are ~~given~~ ^{identified by the} same symbols. In the eighth embodiment shown in Fig. 13, ^{the} cathode-line lead lines 20 of the cathode line 2 are arranged only at one ~~end face~~ ^{the display area AR on the} side of ~~a~~ back substrate 1; and, ^{the} terminals 22 of ^{the} cathode lines 2 are arranged in one line in the y direction, and ^{their ends} ~~are made to~~ extend below ^{the} frame body 90, which constitutes a sealing frame, ~~and superposed on~~ ^{so that} the frame body ~~is superposed thereon~~ 90.

~~FIG. 13~~

Due to ~~such a~~ ^{the} constitution ^{provided by} of this embodiment, it is possible to make ~~the~~ ^{an} existing constitutional member also function as the shield member, ^{in addition to} ~~not to mention~~ the above-mentioned advantageous effect ^{in which} ~~of suppressing~~ the generation of ^a spark or ^a dark current, ^{is suppressed whereby} ~~the~~ enhancement of ^{the} operability and ~~the~~ reduction of cost can be expected. Further, it is possible to obtain ^a ~~the~~ display device which can ^{produce a} ~~perform the~~ high-definition display and can exhibit high reliability and ^a long lifetime, while ^{simultaneously} obtaining the advantageous effect of the fourth embodiment ~~simultaneously~~.

~~FIG. 14~~

Fig. 14 is a developed perspective view ~~for~~ ^{overall} schematically showing the ~~whole~~ ^{whole} constitution of a display device of the present invention. The display device shown in Fig. 14 is based on the constitution of the third embodiment of the present

invention shown in Fig. 5 and Fig. 6. In Fig. 14, on an inner surface of the back substrate 1, a large number of cathode lines 2 ^{a first} which extend in ~~one~~ direction (y direction) and are juxtaposed in ^{a second} ~~another~~ direction (x direction) which crosses the above-mentioned ^{first} ~~one~~ direction ~~are formed~~. Electron emitting sources, such as carbon nanotubes, are formed on face-substrate-21-side surfaces of ^{the} cathode lines 2. Further, there are ~~provided~~ control electrodes 4 formed of a plurality of strip-like electrode elements 41, which extend in ^{the above-mentioned second} ~~another~~ direction (x direction) ^{so as to} ~~which~~ cross ~~the~~ ^{first} cathode lines 2 and are juxtaposed in the above-mentioned ~~one~~ ^{first} direction (y direction). In the ^{the} drawing, electron passing apertures are omitted. Further, an anode and a fluorescent material are formed on the inner surface of the face substrate 21. The back substrate 1 and the face substrate 21 are sealed by the frame body 90.

~~[0049]~~

A shield member 45 is provided inside a frame body 90, and ^{the} terminals 22 of ^{the} cathode lines 2 and an anode formed on an inner surface of ^{the} ~~a~~ face substrate 21 are shielded from each other by the shield member 45. Video signals are supplied to the cathode lines 2 through ^{the} cathode-line lead lines 20. Control signals (scanning signals) are supplied to the control electrodes 4 through ^{the} control electrode lead terminals 40.

~~[0050]~~

^{a diagram showing}
Fig. 15 is ~~an explanatory view of~~ an example of an

equivalent circuit of the display device of the present invention. ¹⁶~~A~~ region indicated by a broken line in the drawing indicates a display region. In the display region, the cathode lines 2 and the control electrodes 4 (strip-like electrode elements 41) are arranged to cross each other, thus forming a matrix of $n \times m$. display elements Respective crossing portions of the matrix constitute unit pixels and one color pixel is constituted of a group of "R", "G", "B" elements in the drawing. The cathode lines 2 are connected to a video drive circuit 200 through the cathode-line lead lines 20 (X1, X2, ... Xn), while the control electrodes 4 are connected to a scanning drive circuit 400 through control-electrode lead lines 40 (Y1, Y2, ... Ym).

~~0051~~

The video signals 201 are inputted to the video drive circuit 200 from an external signal source, while scanning signals (synchronous signals) 401 are inputted to the scanning drive circuit 400 in the same manner. Accordingly, given pixels, which are sequentially selected by the strip-like electrode elements 41 and the cathode lines 2, emit light in given colors, thus displaying two-dimensional images. With the use of ~~the~~ ⁹ display device ~~of the example~~ having such a constitution, it is possible to realize a flat-panel type display device which can be operated with high efficiency at a relatively low voltage.

~~0052~~

Illustrated

As has been explained in conjunction with ^aembodiments, according to the typical constitutions of the present invention, by shielding the terminals of the cathode lines from the anode using ~~the~~ ^a shield member, it is possible to prevent the generation of ~~the~~ ^a spark and ~~the~~ ^a dark current and to obviate ^athe creation of an unstable display and ^adegraded display, whereby ~~the~~ ^a display device which exhibits ^a~~the~~ long lifetime and ^a~~the~~ which produces images with a high reliability can be provided.